REMARKS

By the present Amendment, claims 39 and 45 have been amended. No claims have been added or cancelled. Accordingly, claims 39-47 remain pending in the application. Claims 39 and 45 are independent.

In the Office Action of July 13, 2007, claims 39-50 were rejected under 35 USC §103(a) as being unpatentable over Japanese Patent JP 9-17770A to Fukuda in view of U.S. Patent No. 6,921,724 issued to Kamp et al. ("Kamp"). This rejection is respectfully traversed.

In rejecting the claims, the Office Action alleges that Fukuda discloses a plasma processing method that comprises all of the steps recited in the claimed invention. The Office Action admits that Fukuda fails to expressly teach processing upper and lower films on a specimen with different temperature profiles, as well as the temperature settings being adjusted based on information obtained before processing the specimen. Kamp is relied upon for disclosing these particular features.

By the present Amendment, Applicants have amended the claims to better define the invention and identify features that are not disclosed or suggested by the art of record. As amended, independent claim 39 defines a plasma processing method that comprises:

> a step of locating a specimen on a specimen table provided inside a processing chamber, a step of supplying a processing gas during evacuating inside of the processing chamber from the lower portion thereof, a step of generating plasma inside the processing chamber to process a plurality of films stacked on the specimen, wherein the specimen table comprising a dielectric film comprising an upper surface of the specimen table on which the specimen is located and a central channel disposed in a central portion of a heat conductive block of the specimen table, an outer circumferential channel in an outer circumferential portion of the metal block and a ring-like part with

a lower heat conductivity than that of the heat conductive block suppressing a heat conduction between the central portion and the outer circumferential portion thereof disposed between the central channel and the outer circumferential channel inside the heat conductive, the plasma processing method further comprising:

a step of circulating coolant inside each of the central channel and the circumferential channel, the temperature of the coolant in the central channel is adjusted higher at a predetermined temperature difference than that of the coolant in the circumferential channel;

a step of absorbing electrostatically the specimen on the dielectric film and holding the specimen thereon;

a step of supplying the heat conductive gases to spaces between the specimen rear surface and the dielectric film, the spaces being constituted to independent spaces of a central space and an outer circumferential space by a ring-like protrusion which is disposed on the dielectric film at a position above the ring-like part inside of the heat conductive block and contacts closely with the rear surface of the specimen by the electrostatic absorption, and adjusting a pressure of the heat conductive gas in the outer circumferential space to be higher than that of the heat conductive gas in the central space at a predetermined value of a pressure difference; and

after processing an upper film of the plurality of films on the specimen while maintaining the temperatures of the coolant and the pressures of the heat conductive gases, changing the value of the pressures of the heat conductive gases in the central space and the outer circumferential space, while the temperatures of the coolant is maintained, and processing a lower film of the plurality of films on the specimen.

According to at least one feature of independent claim 39, the specimen table comprises a dielectric film having an upper surface of the specimen table and a central channel that is disposed in a central portion of a heat conductive block thereof; an outer circumferential channel in an outer circumferential portion of the heat conductive block; and a ring-like part with a lower heat conductivity than that of the heat conductive block disposed between the central channel and the outer circumferential channel inside the heat conductive block in order to suppress heat conduction between the central portion and the outer circumferential portion. Further, according to independent claim 39, processing gas is supplied during

evacuation of the processing chamber from a lower portion thereof and generating plasma inside the processing chamber to process a plurality of films that are stacked on the specimen. The specimen is also electrostatically adsorbed on the dielectric film.

According to additional features, coolant is circulated inside each of the central channels as well as the circumferential channel. The temperature of the coolant in the central channel is adjusted higher at a predetermined temperature difference than that of the coolant in the circumferential channel. Heat conductive gases are supplied to the spaces between the specimen rear surface and a dielectric film that comprises an upper surface of the specimen table. The spaces where the heat conductive gases are supplied are independent spaces that consist of a central space and an outer circumferential space by virtue of the ring-like protrusion which is disposed on the dielectric film at a position above the ring-like part inside the heat conductive block, and contacts the rear surface of the specimen. Further, the pressure of the heat conductive gas in the outer circumferential space is adjusted so that it is higher than that of the heat conductive gas in the central space by a predetermined pressure difference. Additionally, after the upper film of the plurality of films on the specimen has been processed, the temperatures of the coolant and the pressures of the conductive gases are maintained. Subsequently, the value of the pressures of the heat conductive gases are changed in the central space and the outer circumferential space while the temperature of the coolant is maintained. The lower film of the plurality of films on the specimen is then processed.

According to the invention defined by independent claim 39, it is possible to achieve a well-modulated temperature distribution at the surface of the dielectric film. Furthermore, the temperature distribution at the slit (257) varies greatly in order to

act as a boundary and suppress heat conduction. See paragraphs [0089] and [0090] of the published application. It is also possible to quickly and efficiently respond to a temperature difference between the processing steps of a film of the semiconductor wafer surface even if the temperature difference is large. See paragraphs [0103] – [0116] of the published application. For example, when the temperature difference of the temperature distribution to be changed is from 3°C to 5°C between the adjoining steps, the temperature change is adjusted by controlling the pressure difference of the heat conducting gas. See paragraph [0110]. When the temperature difference of the temperature distribution to be changed is large (e.g. 3°C to 18°C) between the adjoining steps, the change in difference of the temperature distribution is achieved by the temperature control device as well as the pressure control device. See paragraph [0112] and [0113].

The Office Action alleges that Fukuda discloses various features of the claimed invention including a ring-like part with a lower heat conductivity than that of the heat conductive part, the ring-like part being disposed between the central channel and the outer circumferential channel inside the heat conductive block, a ring-like protrusion disposed on the dielectric film at a position above the ring-like part inside of the heat conductive block, etc. Applicants respectfully disagree.

Fukuda does not appear to provide any special parts that are disposed between the central channel and outer circumferential channel inside the heat conductive block. Further, according to Fukuda, ethanol is used as a coolant and circulated through channels 11 and 14 inside of the stage (9). See paragraph [0030] of Fukuda. The stage, however, is surrounded by an insulator (8) and functions as an electrically conductive member. Fukuda appears to be completely silent on the material used for constructing the stage. If this material is aluminum, then its thermal

conductivity is 237$Wm^{-1}K^{-1}$, while the thermal conductivity of ethanol 0.166$Wm^{-1}K^{-1}$ at 300°K. As can be appreciated, the thermal conductivity of the stage is significantly large with respect to the thermal conductivity of the liquid coolant. Consequently, the features of independent claim 39 cannot be achieved.

Fukuda also indicates that the temperature control gas is emitted from separate areas (31 and 32). While Fukuda appears to indicate that the gas supply portion can be divided, it does not disclose or suggest utilizing a protrusion to divide the two areas from each other in the minute space between the surface of the electrostatic chuck (34) and the wafer (W). See paragraph [0035] of Fukuda. Since Fukuda fails to disclose various structural features that are directly required to perform the steps of the invention, it is necessarily incapable of disclosing or suggesting such steps. For example, Fukuda discloses at paragraph [0031], that the refrigerant temperature in refrigerant passage (11) is 0°C, while the refrigerant temperature in refrigerant passage (14) is 5°C. Fig. 2 shows the relationship between the stage temperature obtained in this process and the skin temperature of the wafer. There is simply no indication or suggestion that the upper and lower films are processed with different temperature profiles.

Review of Kamp has also failed to reveal any disclosure or suggestion for some of the features alleged to be disclosed by the Office Action. For example, Kamp discloses a support (306) that comprises a ceramic material and a heater (308) embedded in the support. However, there is no indication that the support is a heat conductive block. Furthermore, Kamp completely fails to disclose any component that would correspond to a ring-like part with a lower heat conductivity than that of the heat conductive block as set forth in the claimed invention. Kamp also fails to disclose or suggest the ring-like protrusion being disposed on the

dielectric film as set forth in the claimed invention. While Kamp appears to disclose a plurality of heaters (308) that can arguably correspond to a central channel and an outer circumferential channel disposed in the heat conductive block, it is completely silent on a ring-like protrusion that has a lower heat conductivity than that of a support (306) among these channels.

Furthermore, during the processing steps disclosed by Kamp, the inner temperature and the outer temperature are decreased independently during the etching process in order to increase the profile rounding at a trench bottom. The etching process begins with a high temperature that is incrementally dropped over a series of steps. Further, the temperature change between each step in the series is 4° C or less. See column 8, line 59, to column 9, line 49 of Kamp. This temperature change clearly corresponds to the small temperature change discussed in the present invention. Kamp does not provide any disclosure or suggestion for large changes of the temperature distribution by controlling two different temperature methods.

The cited references do not appear to provide any disclosure or suggestion for combining two different types of temperature control methods as set forth in the present invention. Importantly, these references fail to provide any disclosure or suggestion for specific features recited in independent claim 39, such as:

> a step of circulating coolant inside each of the central channel and the circumferential channel, the temperature of the coolant in the central channel is adjusted higher at a predetermined temperature difference than that of the coolant in the circumferential channel;
>
> a step of absorbing electrostatically the specimen on the dielectric film and holding the specimen thereon;
>
> a step of supplying the heat conductive gases to spaces between the specimen rear surface and the dielectric film, the

spaces being constituted to independent spaces of a central space and an outer circumferential space by a ring-like protrusion which is disposed on the dielectric film at a position above the ring-like part inside of the heat conductive block and contacts closely with the rear surface of the specimen by the electrostatic absorption, and adjusting a pressure of the heat conductive gas in the outer circumferential space to be higher than that of the heat conductive gas in the central space at a predetermined value of a pressure difference; and

after processing an upper film of the plurality of films on the specimen maintaining the temperatures of the coolant and the pressures of the heat conductive gases, changing the value of the pressures of the heat conductive gases in the central space and the outer circumferential space, while the temperatures of the coolant is maintained, and processing the lower film of the plurality of films on the specimen.

It is therefore respectfully submitted that independent claim 39 is allowable over the art of record.

Claims 40-44 depend from independent claim 39, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 39. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

As amended, independent claim 45 defines a plasma processing method that comprises the steps of:

a step of circulating coolant inside each of the central channel and the outer circumferential channel, the temperature of the coolant in the central channel is adjusted higher at a predetermined temperature difference than that of the coolant in the circumferential channel;

a step of absorbing electrostatically the specimen on the dielectric film and holding the specimen thereon;

a step of supplying the heat conductive gases to spaces between the specimen rear surface and the dielectric film, the spaces is constituted to independent spaces of a central space and an outer circumferential space by a ring-like protrusion which is disposed on the dielectric film at a position above the ring-like part inside of the heat conductive block and contacts closely with the

rear surface of the specimen by the electrostatic absorption, and adjusting the pressure of the heat conductive gas in the outer circumferential space to be higher than that of the heat conductive gas in the central space at a predetermined value of a pressure difference; and

after processing an upper film of the plurality of films on the specimen maintaining the temperatures of the heat conductive block and the pressures of the heat conductive gases, changing the pressure difference of the heat conductive gases between the central space and the outer circumferential space smaller, while the temperatures of the portions of the heat conductive block is maintained and processing the lower film of the plurality of films on the specimen.

Independent claim 45 recites various features that are somewhat similar to those recited in independent claim 39. For example, coolant is circulated inside each of the central channel and the outer circumferential channel, and the temperature of the coolant in the central channel is adjusted higher at a predetermined temperature difference than that of the coolant in the circumferential channel. Further, heat conductive gases are supplied to the spaces between the specimen rear surface and the dielectric film, and the pressure of the heat conductive gas in the outer circumferential space is adjusted to be higher than that of the heat conductive gas in the central space at a predetermined value of a pressure difference. As previously discussed with respect to independent claim 39, these features are not shown or suggested by the art of record.

It is therefore respectfully submitted that independent claim 45 is allowable over the art of record.

Claims 36 and 47 depend from independent claim 45, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 45. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

I. Conclusion

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 520.42565CX1).

Respectfully submitted,
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Dated: February 19, 2008